DOCUMENT RESUME

ED 312 709 CS 506 886

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TITLE Technology, Sound and Popular Music.
PUB DATE May 89
NOTE 21p.; Paper presented at the Annual Meeting of the International Communication Association (39th, San Francisco, CA, May 25-29, 1989).
PUB TYPE Speeches/Conference Papers (150) -- Viewpoints (120) -- Reports - Evaluative/Feasibility (142)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Audio Equipment; *Audiotape Recordings; Bands (Music); Media Research; Music; Musicians; *Music Techniques; Rock Music; *Technological Advancement
IDENTIFIERS *Popular Music

ABSTRACT

The ability to record sound is power over sound. Musicians, producers, recording engineers, and the popular music audience often refer to the sound of a recording as something distinct from the music it contains. Popular music is primarily mediated via electronics, via sound, and not by means of written notes. The ability to preserve or modify organized sound is a means of controlling sound independent of its creation or creator. Recording enables the fixation of music based on improvisation, one of popular music's most important characteristics. Recording technology has greatly affected the recreation of studio sound in a performance setting--it is now common for a group to make a digital sample of the sounds created in the studio and use those in performance. Popular music production has traditionally been concerned with finding new sounds and reconfiguring old ones. This search for new sounds is at the heart of modern musical instrument technology. Authenticity is again at stake, for there is a rift between those who create their own sounds and those who buy others' sounds. Record producers as well as the identity of a group or artist can be associated with sound. Recording technology, as the means by which sound is manipulated and reproduced, is the site of control over sound, and therefore the site of musical and political power in popular music. (Thirty-six notes are included.) (MG)

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# Technology, Sound and Popular Music

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Abstract

The paper is an examination of the changes in the relations of production of popular music due to technological change. It is argued that sound is the organizing concept in popular music, and its manipulation and ordering form the foundation not only for popular music production but for its consumption as well. The political, economic and creative practices of sound and sound recording are discussed and their relationships examined.

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Technology, Sound and Popular Music

The ability to record sound is power over sound.

If it can be recorded, it can be played back. It can be played forward, backward, faster, slower. Only parts of the recording can be played, sound can be cut out, put together with other sounds and played back, and so on. The fundamental goal of recording technology is to provide this power over sound, and it is squarely within the realm of Harold Innis' notions of bias and control in communication.[1] It is a technology firmly rooted toward control of space and time -- control of time by capture and manipulation of sound, control of space by capture and manipulation of the sound's environment. As Innis notes, different types of media have different biases, and this is true of recording media. Compared to wire recorders, for instance, the inclusion of fast forward and rewind controls on tape recorders shows a bias toward time. Tape recorders save a lot of time when one is searching for a specific point in a recording. Likewise, digital sequencers (and some digital recorders) require virtually no time at all to precisely locate any point in a recording.

Musicians, producers, recording engineers and the popular music audience often refer to the sound of a recording as something distinct from the music it contains. One can admire a group for having "a really good sound," despite being musically incompetent. Rock and roll in particular is largely categorized by sound. The Rolling Stone Illustrated History of Rock and Roll contains chapters on the "Sound of New Orleans," "The Sound of Chicago," "The Sound of Texas," "The Sound of Memphis," "The Sound of San Francisco," the Motown sound, and so on.[2]

What is the definition of sound in these terms? Essentially, the organization of noise by means of the recording process. But before that process can be examined, the parameters of sound in popular music must be illustrated.

## Noise & Sound

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> Sound exists only when it is going
> out of existence.
>
> -- Walter J. Ong
> Orality & Literacy

Sound is essentially ephemeral, as Ong notes.[3] It occurs in time, is so bound by time that it cannot, he says, be stopped. To stop sound is to create silence. From this we can glean the difference between sound and music. Sound is that which occurs over time, cannot be stopped, and is irreducible. It cannot be examined in the same way that one can examine music via a musical manuscript, note for note, measure for measure. One can listen to or perform a piece of music, measure for measure, over and over, but as each second passes so does the sound that has occurred. Sound cannot be frozen for close examination like notes on a page of sheet music. Its experience takes place over time, while reading sheet music is not time-bound. Musical notation, sheet music, allows us to capture music. Recording allows us to capture sound.

The distinction between music and sound is most clear in terms of Innis's (and McLuhan's) definitions of communication. Popular music is primarily mediated via electronics, via sound, and not by means of written notes. Folk music and popular music are transmitted by means of performance, they are traditionally not written. As Paul Willis explains,
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> The ascendancy of pop music marked the decline of sheet music as the main distributed form of popular music. Sheet music could be played in very different ways by different groups at different times. The essence of music, the common denominator between groups, was the notation on the sheet. In the age of pop music, the only text is the actual record. This makes the precise style and intonation of the singer very important.[4]

The distinction is most clearly embodied in the way groups copy each other's songs. They listen to recordings, play along with them, and decipher the music from recordings. Most groups do not read sheet music, and many pop musicians cannot read music. Music is organized sound, but music notation is not the image of sound -- it is the organization of instructions for the creation of sound.

The ability to preserve or modify organized sound is a means of controlling sound independent of its creation and creator. Therefore the recording of sound is a profoundly political act, as Jacques Attali identifies:

> Recording has always been a means of social control, a stake in politics, regardless of the available technologies. Power is no longer content to enact its legitimacy; it records and reproduces the society it rules. Stockpiling memory, retaining history or time, distributing speech, and manipulating information has always been an attribute of civil and priestly power, beginning with the Tables of the Law. But before the industrial age, this attribute did not occupy center stage: Moses stuttered and it was Aaron who spoke. But there was already no mistaking: the reality of power belonged to he who was able to reproduce the divine word, not to he who gave it voice on a daily basis. Possessing the means of recording allows one to monitor noises, to maintain them, and to control repetition within a determined code. In the final analysis, it allows one to impose one's own noise and to silence others.[5]

Deciding what is recorded, what song or what sound, is the critical political struggle in popular music production, not only because most people's experience of popular music is mediated via recordings (and therefore sound is the means by which the audience identifies music and the recording artist) but because it is the site of power, the area where one can "impose one's own noise and...silence

others."

The first articulation of the power of recording sound comes from the early twentieth-century avant garde, within which futurism and dadaism took root. In 1909 Marinetti wrote the first futurist manifesto, paving the way for musique concrete and electronic music, only now being commercially realized in the mainstream with the advent of digital synthesizers and digital sampling technology. Marinetti wrote,

> We will sing of great crowds excited by work, by pleasure and by riot; we will sing of the multicolored, polyphonic tides of revolution in the modern capitals; we will sing of the nightly fervor of arsenals and shipyards blazing with violent electric moons; greedy railway stations that devour smoke-plumed serpents; factories hung on clouds by the crooked lines of their smoke; bridges that stride the rivers like giant gymnasts, flashing in the sun with a glitter of knives; adventurous steamers...deep-chested locomotives...and the sleek light of planes.[6]

Futurism and dadaism fostered a spirit of adventure among artists, most evident in Busoni's "Sketch of a New Aesthetic of Music" in which he declared, "the creative artist does not follow laws already made, but...he makes laws."[7] This spirit, along with futurism's embrace of the modern, meant that new music technology such as the phonograph, the electric organ, and the Dynamophone, would find a place among composers and artists. An important influence on avant garde music was the publication in 1913 of Russolo's "The Art of Noises," in which he "suggested fixing the pitch of noise sounds."[8] This opened the door for musique concrete, forged a direct link between futurism and music, paving the way for everyday sounds -- industrial noises, traffic sounds, etc. -- to be used as the raw material of music. The moment was a crucial one especially when viewed in light of the current widespread use of digital samplers. These instruments record external sounds and allow them to be played back anywhere on a keyboard.[9]

On a deeper level, publication of "The Art of Noises" was the point at which music theory ceased to be dictatorially controlled by traditional western

musical ideas such as pitch and rhythm (which lent themselves to notation). Avant garde music by its very nature lent itself to technology and to recording. It was difficult to write down in a systematic manner, and it relied on sounds that, in some cases, were not perfectly repeatable (the screech of a train's brakes, for example, or the sound of a factory). The connection to sound recording technology is direct. As Frank Biocca writes, "no longer would black marks on paper be the only manner to hold still a fleeting melody, now sound itself could be captured. The link between music, sound, and technology became fused in the mind of the avant garde."[10]

In other words, one could now notate, by means of recording, the signifiance of music, the "grain of the voice" as Barthes calls it.[11]

This is not to say that composers had been unaware of sound up to this point, or that pitch and rhythm have been abandoned, for that is clearly not the case. Early twentieth-century avant garde composers became more aware of sound as a malleable form, however. The difference was one of perception. Recording technology allowed for their control over sound by means of editing, tape manipulation, and the like. It also allowed for repetition of sound so that composers could hear their own (and other) pieces over and over again, with no need for performers. Biocca states,

> the phonograph and radio participated in the process of musical change by preparing the audience, musicians, and composers for new forms of aural experience, by shifting the sensory ratio in favor of greater cognitive attention to hearing, and also by diffusing the new experiments in sound.[12]

By the late 1930s and early 1940s, sound had become the organizing principle in music. Electronic instruments were available, as well as relatively inexpensive recording devices. Ernst writes, "composers were beginning to think in terms of timbral relation; oscillators and instruments capable of controlling timbre had been perfected."[13]

Sound and Popular Music

It was not until the late 1960s that many of the innovations of avant garde music found their way into mainstream popular music, most notably in the Beatles' music. However, the seeds for the intersection of the avant garde and the popular were planted earlier in several ways. First, as mentioned earlier, recording technology gave power over sound and permitted reconfiguration and juxtaposition of sound. During the 1950s, popular musical parodist Spike Jones relied on recording sound effects to create humor in his music (perhaps not coincidentally, Jones' producer was George Martin, who later produced the Beatles' recordings). Second, and more importantly, recording enabled the fixation, and therefore repetition, of music based on improvisation. The implication for popular music is remarkable. The following paragraph by Jones and Rahn illustrates the relationship between repetition and improvisation (albeit in a backhanded way):

> In accord with Adorno's view of popular music as a standardized product subject to variation, Howard Brown asserts that a popular piece retains its germane characteristics despite considerable deviations from the original version. Rearranging and improvisation play a large role in popular music. This range of variability is probably related to aural transmission and to the audience's and performer's lack of concern about the composer's intentions. In this regard, popular music resembles traditional folk music, which has also circulated in an oral tradition and whose composers have largely been forgotten. Groups such as Liverpool, which imitate Beatles' arrangements note for note, are closer to classical performance practices than to those that we usually associate with popular music.[14]

Jones and Rahn are correct in identifying improvisation as one of popular music's most important characteristics. Recording technology's reconciliation of popular music as a standardized yet improvised product is what makes it the site of

struggle and creation of popular music.

The mention of Liverpool is interesting because the group is identified as being within the realm of "classical performance practices" because of their note-for-note imitation of Beatles' songs. Few popular groups perform even their own compositions note-for-note. However, in live performance most do attempt to achieve a sound close to the one they achieved in the recording studio.

The reasons for this are not quite clear, and may be dominated by economics as much as aesthetics. Perhaps the group feels the studio sound best realizes its compositions' potential (that is, maybe they simply like the studio sound). It could also be that the group wants to imitate its recording so that the audience will purchase the recording, or the group feels it may alienate the audience by not adhering to a sound with which it is already familiar. The authenticity of rock 'n' roll is closely connected to the distinction between live and studio performance, and rock groups often state in interviews that the stage and studio must be kept distinct -- it is difficult to exactly reproduce a studio recording on stage. Punk groups valued live performance as the best means of expression since it was a direct link to the audience, and therefore the most authentic expression.

Recording technology has greatly affected the recreation of studio sound in a performance setting. At one time it would have been difficult for a group such as Pink Floyd, for example, to exactly reproduce its studio sound on stage. Now, however, it is common for a group to make a digital sample of the sounds created in the studio and use those in performance (as recently done by the Philip Glass Ensemble and Howard Jones, among others). Live performance is thereby linked both to the studio and to the technology of recording via sound. It is now possible to sample the sound of a 40-piece orchestra that was employed in the studio (indeed, it is likely that an orchestra was not used in the studio, but that a sample was) and include that as part of a live performance, with no need for an actual orchestra. Its sound has been extrapolated from its creators and power over the sound has changed hands. This results in a tremendous savings of

time and money for producers, engineers, record companies, etc., who do not have to hire and record the orchestra. But it is no wonder that musicians' unions are having difficulty coping with and accepting much of the new recording technology. Not only can it take jobs away from musicians; it can wrest political control over their sound away from them. There is little (at this time) that can stop someone from sampling the sound of a philharmonic orchestra from an LP record for use in a studio.

Although the contradiction between repetition and improvisation in popular music may be reconciled in the recording process, the contradictions of sound and originality in popular music are not, especially in rock and roll. Groups attempt to forge a unique, individual sound, yet one not too far removed from an established framework. Their sound serves both to place them within a given social, cultural and political area, and to set them apart from others in that area. Bob Dylan placed himself in an interesting situation at the 1965 Newport Folk Festival when he switched from acoustic to electric guitar, in one stroke (strum) alienating much of his folk audience and proving the political power of sound in popular music. The experience and ideology of folk music were based on the acoustic guitar, an instrument that could be played anywhere and was designed to be heard by a small group of people. The electric guitar carried the image of rock music and amplification intended to increase its reach to a large audience. Dylan's folk audience was well aware of this and considered his switch to electric guitar a form of "selling out."

**Rock: Sound and Culture**

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Two examples are typical of the cultural function of sound in popular music. The first is that of the Sun sound.

Epitomized by the early recordings of Elvis Presley, the Sun sound was the

creation of Sam Phillips, owner of Memphis-based Sun Records. Several histories of Sun exist[16] so I will not recount its history here. Suffice it to say that many consider the Sun Records studio to be the place where rock 'n' roll was born. What is important to the matter at hand is that Sun had a unique sound, identifiable (a combination of white country and black blues styles) yet uncharacteristic of other recordings of the mid-Fifties. Peter Guralnick describes Phillips' style:

> His production methods were instinctive and almost always appropriate. Like Leonard Chess he was one of the first to go for a heavy echo effect, but the overall sound was crisp, clean, and full of life.[17]

Iain Chambers goes further:

> Listening to the recordings that Elvis made for Sam Phillips in Memphis in the mid-1950s and comparing them with those made a little later for the same Sun label by Carl Perkins, the magisterial power of Presley's performance is unmistakable. With Perkins there are similar musical currents at work, but the respective country and blues elements remain less integrated; his voice tends to cut across and over the instrumental backing. Presley's voice, however, has a 'voluptuous' presence within the music. This is particularly evident if we compare the two singers respective recordings of 'Blue Suede Shoes.' It indicates Elvis's greatest debt to the blues. <u>It is an aural difference that permits us to appreciate both Presley's fundamental importance in white popular music and Roland Barthes' point that in the 'grain' of the singing voice it becomes possible to locate a cultural sense.</u> (emphasis mine)[18]

The Sun sound was dictated by the available recording technology as much as by Phillips' production values (which were in turn affected by the technology) and Presley's talent. In the mid-1950s Phillips had available a tape machine capable of capturing a live performance in a monaural recording. There was no capability for overdubbing (layering of tracks) and it is likely that some of the spontaneity that comes across in the Sun recordings is due to the live performance turned in by the musicians grouped together in the same room. The "live" quality also stems in part from the microphone placement -- they were not

isolated (since the musicians were in the same room), but could pick up some of the ambient room sound as well as adjacent instruments.

The "cultural sense" to which Chambers refers is crucial to popular music. It creates a space within which popular music can operate, and a space within which audience discourse concerning popular music takes on meaning, in terms of sound.[19]

A recent (and critical) example of the importance of sound to popular music comes from British punk rock. Punk created a climate in which anyone could form a band and many wanted to. This sudden explosion of new groups, forming and breaking up seemingly overnight, caught the recording industry off guard. The finest reflection on punk rock came with release of the film "The Great Rock 'n' Roll Swindle." While showing that rock 'n' roll had become a swindle, exploiting the youth it catered to, it revealed punk bands, as part of rock 'n' roll, must likewise be a deception.

One of punk rock's aims was to disavow mainstream rock as a corporate farce, removed from its fans, by pointing out what a farce rock had become. But in so doing it pointed out that it too had to be a farce, as caught up with the music business as mainstream rock (witness the Clash's signing to CBS, or the Sex Pistols' to EMI, then Virgin).

The emphasis in punk was on the live performance. Groups with little or no musical training performed in small, crowded bars, in direct opposition to the elaborate staging and musicianship of mainstream groups such as Genesis, Electric Light Orchestra and Queen. Despite the emphasis on performance, though, punk bands desperately wanted to release records (and many started their own record labels to do so). It is one of the (many) contradictions of punk rock that, despite denying connections to rock's history, it nonetheless articulated itself within the standard medium of rock music.[20]

Punk groups were not keen to go into recording studios, since many viewed the studio as the place were rock had become stagnant, where bands would hole up and shut themselves off from their audience. "Everyone is so fed up with the old

way," Johnny Rotten of the Sex Pistols said in a story in Melody Maker magazine. The story's author, Caroline Coon, added, "For three years we accepted the situation, almost stunned. Theatrical bands like Queen, Roxy Music and 10cc tried to anaesthetize us with dollops of romantic escapism and showbiz gloss...there is a growing, almost desperate feeling that rock music should be stripped down to its bare bones again."[21]

Punks wanted nothing to do with any of those showbiz trappings, including the standard process of recording, which took anywhere from several weeks to several months, with a producer in strict control of the proceedings. Part of the political struggle of punk against mainstream rock took place over sound; "stripped down" versus "gloss(y)."

Dave Laing describes mainstream recording as it developed in the 1970s:

> Since the rewards from a global hit were potentially vast, the (major labels) were willing to invest large sums in the preparation of both artists and recordings. Most of that money was spent on and in recording studios, whose technology had become increasingly sophisticated. In particular, the exponential increase during the decade in the number of tracks, or channels of sound, into which the music to be recorded could be separated, allowed musicians and producers to manipulate the sounds to an unprecedented degree.
>
> In the popular music sphere of 1976, the expert manipulation of that technology...had become accepted as the precondition for successful and competent music. Although punk rock was soon to prove that exciting and valid recordings could be made for a fraction of the cost, the generality of musicians in 1976 identified good records with expensive ones. And since the only source of adequate finance for the studio costs of a good recording was the major or large independent label, the only path to artistic success musicians could imagine lay through convincing those labels that one's own work would prove commercially viable.[22]

Punk groups regarded studio recording as an extension of live performance, and recorded in a fashion not unlike Phillips used at Sun Records. As Phillips recorded and released records on his own label, so punk bands released self-made records on their own labels. Most punk recordings were made in small four- or eight-track studios, using equipment left over from the 1950s and 1960s. For the

many bands that did not sign to a record company, recording in technologically sophisticated studios was not only aesthetically unacceptable, but economically out of the question. However, as large studios bought new equipment and sold the old, some smaller studios were in a position to buy up the used equipment and offer recording time at rates affordable to most punk bands. These smaller studios were not equipped to do much more than live recording, on a kind of do-it-yourself basis (which suited punk aesthetics). However, had it not been for technological development which forced down the price of old technology, it is likely that punk bands would not have been able to do very much recording at all. A group like Generation X was able to rent recording equipment, set it up in their apartment, learn how to use it and record their first album.

What was ultimately at stake was the concept of authenticity. The punks felt that, by doing things themselves, they were more direct, more honest than the rock stars that had dominated popular music in the 1970s. They boldly articulated what had become a tradition in rock 'n' roll since the 1950s. As Mike Stoller, of the Leiber and Stoller songwriting team (responsible for many 50s hits by the Coasters and Elvis Presley, among others) said about Presley's artistic decline, "he no longer appeared in public...he wasn't getting the feedback. He was insulated. There was none of the go-for-broke situation that creates exciting performances."[23]

The punks wanted, more than anything else, to be in touch with their audience; most of them had, at some point, been audience members.

Technology is intimately connected to rock's notions of honesty and directness. It lets one reproduce and manipulate sound, and the development and design of recording equipment is biased toward easier manipulation of sound and more "faithful" (i.e. more true-to-life, authentic) reproduction. Frith notes the relation of technology and authenticity in popular music;

> Each of these moments in rock history fused moral and aesthetic judgements: rock 'n' roll, rhythm 'n' blues and punk were all, in their turn, experienced as more truthful than the pop forms they disrupted. And in each case

> authenticity was described as an explicit reaction to technology, as a return to the "roots" of music-making -- the live excitement of voice/guitar/drum line-ups. The continuing core of rock ideology is that raw sounds are more authentic than cooked sounds. (emphasis mine)[24]

## New Sounds/Old Sounds

Popular music production has traditionally been concerned with finding new sounds and reconfiguring old ones. As Glyn Johns, record producer and engineer for the Rolling Stones, the Who and others, commented about studio work, "the (recording) engineer (is) being asked for something different, please, because we've heard this one before."[25]

The search for new sounds is at the heart of modern musical instrument technology. New instruments such as the Kurzweil 150 synthesizer are marketed with their sound-creating and sound storage potential as their biggest selling point. "The Kurzweil 150...can create infinite numbers of sound combinations...sound layering techniques enable you to create distinctive sounds with remarkable ease."[26]

A similar trend is evident in sampling and recording technology. The Korg DSS-1 sampler is advertised as being able to bring the performer "into new dimensions of sound," and the Otari MX-70 is advertised as "the perfect multitrack for the synthesizer oriented studio."[27]

The manipulation of sound has never been easier than it is now, nor has it been as vehemently pursued. In fact, a division has arisen between those who create sounds and those who perform them. Synthesizer programmers, such as Bo Tomlyn and Larry Fast, create sounds for their clients and have spawned an industry based on the trading of sounds via tape or computer disk. In April, 1987, Keyboard magazine's five-page classified advertising section contained 111 ads, 74 of them selling sounds for synthesizers or instruction books detailing

how to create one's own sounds. A typical ad reads;

> Ensoniq ESQ-1 Owners, Buy the Best. Volume 1: 40 exceptional sound programs. Only $19.95 for data cassette and program sheets; also tips for effects processing, splits/layers. CZ-101 owners: Affordable, recordable, 32 devastating patches (sounds). Only $13.95 for program sheets and demo cassette.[28]

A computer database, the Performing Artists Network (PAN), contains hundreds of sounds in its Synthbank section which can be accessed via computer modem. The sounds can be downloaded by subscribers and programmed into their synthesizers.

Authenticity is again at stake, for there is a rift between those who create their own sounds and those who buy others' sounds. Creating one's own sounds is currently perceived as more authentic than buying sounds. As stated in Electronic Musician magazine, "Some people are beginning to complain that the extensive use of instruments with the same factory presets (sounds), sampling instruments that use the same (sound) disks, and the wholesale sampling of other people's sounds is producing an objectionable similarity in current music."[29]

By listening to U.S. top 40 radio for a moderate length of time, one can tell which groups use the same sounds, and a certain sonic sameness does creep into top 40 songs.

The identity of a group or artist is associated with sound. Record producer Mickie Most noted of one group, "They've always had a little color in their sound which I think has given them an identity."[30]

Record producers can also be associated with a sound. Glyn Johns said, "(Phil) Spector came up with a sound, and a Spector record could come on the radio now that you and I have never heard before and we'd know it was Phil Spector."[31] Producers are often hired for their ability to get a certain sound on a recording. Recording engineers are likewise hired for their knowledge of recording equipment and talent for getting a sound. Glyn Johns was asked about his production and engineering contribution to the Who's "Who's Next" LP, and his reply was, "First and foremost the sound."[32]

Simon Frith places sound and individuality/authenticity in rock music in the context of artistic creation. "For many fans," he writes, "it (is) this sense of individual creation that first distinguished rock from other forms of mass music."[33] Frith argues that one of the contradictions of rock 'n' roll revolves around the struggle between individuality and commercialism. That struggle is articulated in most successful rock groups' attempts to reconfigure their old sound, the sound that made them successful, with new sounds. The difficulty lies in finding the proper mix of old and new, of avoiding overt repetition, emphasizing progression, without enacting a change so great that the audience will not recognize the group.[34]

Additionally, up-and-coming groups will often imitate the sound of a successful group to be identified as a "hit" group, and hire producers and engineers who can recreate already famous sounds. Blondie's use of producer Richard Gottehrer for the 60s-ish "In the Flesh" is a case in point. Bill Szycmczyk, commenting on his relationship with the Who, said, "Your reputation (as a producer) goes before you, and it's like, 'You hear the way that sounds? Do that to me.'"[35]

It would seem that most groups, and virtually all record companies, know that audiences are well aware of sound. Part of the reason for the audience's reaction to Dylan's switch to electric guitar was because of the radical change to his sound, and part of the reason that groups are signed to record companies is based on their sound's proximity to the current "hit" sound.

The association of sound and individuality also exists at the level of the musician. Rock guitarists are identified by their sound (Jimi Hendrix being one of the first to experiment with the electric guitar's sound potential), and, similarly, users of synthesizers, digital samplers and recording equipment are identified by sound. The fragmentation of sound into discrete, tradeable and saleable units has created a climate in which the musician who can create sound is valued over one who does not. Electronic Musician's editor, Craig Anderton, writes,

> sound is a very personal thing...The question that concerns me is that if more and more musicians forsake programming, how will those musicians express their individuality with synthesizers and samplers? Samplers in particular offer the promise of using the entire world as a sound source, although many musicians seem content to use their samplers simply to copy the "sounds du jour."[36]

Pressure to maintain a sound distinct from others' but within the range of current sounds creates tension when the means to create and reproduce an extremely broad range of sounds is readily available. Just as there is, in rock 'n' roll, a qualitative distinction between live performance and recording, based on authenticity and directness, so too is there a distinction between acoustic and electric sound. Currently another distinction, between electric and electronic sound (electric guitar versus synthesizer), is becoming apparent. As Frith states, the ideology of rock, and therefore its meaning, revolves around sound. Recording technology, as the means by which sound is manipulated and reproduced, is the site of control over sound, and therefore the site of musical and political power in popular music.

Notes
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1) Harold A. Innis, Empire and Communication (Toronto: University of Toronto Press, 1972).

2) Jim Miller, editor, The Rolling Stone Illustrated History of Rock & Roll (New York: Random House/Rolling Stone Press, 1980).

3) Walter J. Ong, Orality and Literacy (London: Methuen, 1982), p. 32.

4) Paul E. Willis, Profane Culture (London: Routledge & Kegan Paul, 1978), p.8.

5) Jacques Attali, Noise (Minneapolis: University of Minnesota Press, 1985), p. 87.

6) Bruno Marinetti, reprinted in Marshall Berman, All That is Solid Melts Into Air (New York: Simon & Schuster, 1982), p. 25.

7) Frederico Busoni, reprinted in Jon H. Appleton and Ronald C. Perera, The Development and Practice of Electronic Music (Englewood Cliffs, NJ: Prentice-Hall, 1975), p. 5.

8) Luigi Russolo, reprinted in Jon H. Appleton and Ronald C. Perera, The Development and Practice of Electronic Music (Englewood Cliffs, NJ: Prentice-Hall, 1975), p. 7.

9) For example, Paul Hardcastle's "19" uses digital sampling to record voices from Viet Nam war broadcasts and play them back in rhythm with the music. Philip Glass uses digital sampling to record a vocal chorus so that he need only transport a keyboard, and not the whole chorus, on tour. Rap music now relies heavily on sampling, as noted in the March, 1987 issue of i-D magazine: "Recordings such as Mantronik's "Hard-Core Hip-Hop" or Ramell-Zee's "Beat Bop" are examples of pure street sounds that use the new techno-bop of sampling. Young Mantronik's gift for lifting sounds, noises or even complete sections from other people's records and then using them on his own has made sampling a real force to be reckoned with." (p. 13) Sampling is a dream come true for futurists and dadaists; a nightmare for copyright legislators.

10) Frank Biocca, "The Pursuit of Sound: Aural Media, Perception, and the Composer in the Early Twentieth Century," paper presented at the Association for Education in Journalism and Mass Communication Annual Convetion, Memphis, TN, August 1985, pp. 9 - 10.

11) "The 'grain' is the body in the voice as it sings, the hand as it writes, the limb as it performs." Roland Barthes, Image, Music, Text (New York: Hill and Wang, 1977), p. 188.

12) Frank Biocca, "The Pursuit of Sound: Aural Media, Perception, and the Composer in the Early Twentieth Century," paper presented at the Association for Education in Journalism and Mass Communication Annual Convetion, Memphis, TN, August 1985, pp. 16.

13) David Ernst, The Evolution of Electronic Music (New York: Schirmer Books, 1977), p.xxiv.
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14) Gaynor G. Jones and Jay Rahn, "Definitions of Popular Music: Recycled," in Gregory Battcock, editor, Breaking the Sound Barrier (New York: E.P. Dutton, 1981), pp. 46 - 47.

15) The March 1987 issue of Spin magazine, in a story on David Bowie, put it best; "...continued popularity depends on a star's ability to demonstrate repeatedly the skills that first entranced his audience." The classic example is that of the Rolling Stones' "(I Can't Get No) Satisfaction" and "Jumpin' Jack Flash," the latter simply inverting the melodic hook while retaining the sound of the former.

16) The best is the chapter on Sun in Peter Guralnick's Feel Like Goin' Home (New York: Random House, Inc., 1971).

17) Ibid., p. 174.

18) Iain Chambers, Urban Rhythms (New York: St. Martin's Press, 1985), p. 37.

19) Conversation among those who listen to popular music often includes a discussion of a group's sound, or of a sound in particular. The March, 1987 issue of i-D magazine, for instance, includes an article on the latest sounds in rap music. Articles regarding sound are a common feature in most music magazines, including those aimed at musicians themselves.

20) It had no choice, since records were both the medium through which groups communicated with an audience beyond their immediate area and the medium favored by radio stations. Few, if any, groups could reach a large audience without releasing a record, and most groups wanted to reach as many people as possible.

21) Melody Maker, July 1976.

22) Dave Laing, One Chord Wonders (Milton Keynes, England: Open University Press, 1985), p. 3.

23) John Tobler and Stuart Grundy, The Record Producers (London: British Broadcasting Corporation, 1982), p. 16.

24) Simon Frith, "Art Versus Technology: the Strange Case of Popular Music," in Media, Culture and Society (London: Sage, 1986), volume 8, p. 266. By "cooked sounds," Frith means sound that is processed by means of technology.

25) Michael Wale, Voxpop (London: George G. Harrap & Co., Ltd., 1972), p. 65.

26) Kurzweil advertisement in Electronic Musician., May, 1987.

27) Korg and Otari advertisements in Electronic Musician, May, 1987.

28) Keyboard, April, 1987, p. 141.

29) Electronic Musician, June, 1986, p. 58.

30) John Tobler and Stuart Grundy, The Record Producers (London: British Broadcasting Corporation, 1982), p. 136.

31) Michael Wale, Voxpop (London: George G. Harrap & Co., Ltd., 1972), p. 77.

32) Ibid., p. 75.

33) Simon Frith, Sound Effects (New York: Pantheon Books, 1981), p. 53.

34) For some groups this is not hard, and relates to Barthes' concept of signifiance. The Rolling Stones, the Beatles, U2, Talking Heads, and others, have vocalists whose voices are so recognizable that the instrumental backing can change dramatically from song to song, or record to record, without doubt of the group's identity.

35) John Tobler and Stuart Grundy, The Record Producers (London: British Broadcasting Corporation, 1982), p. 89.

36) Electronic Musician, September, 1986, p. 6.